

Fig. 1  
PRIOR ART

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS Filed: 10/31/03  
Inventors: Mark Holtapple et al.  
Attorney Docket: 017575.0782 Page 2 of 51  
(TAMUS 1955/1603/1571)

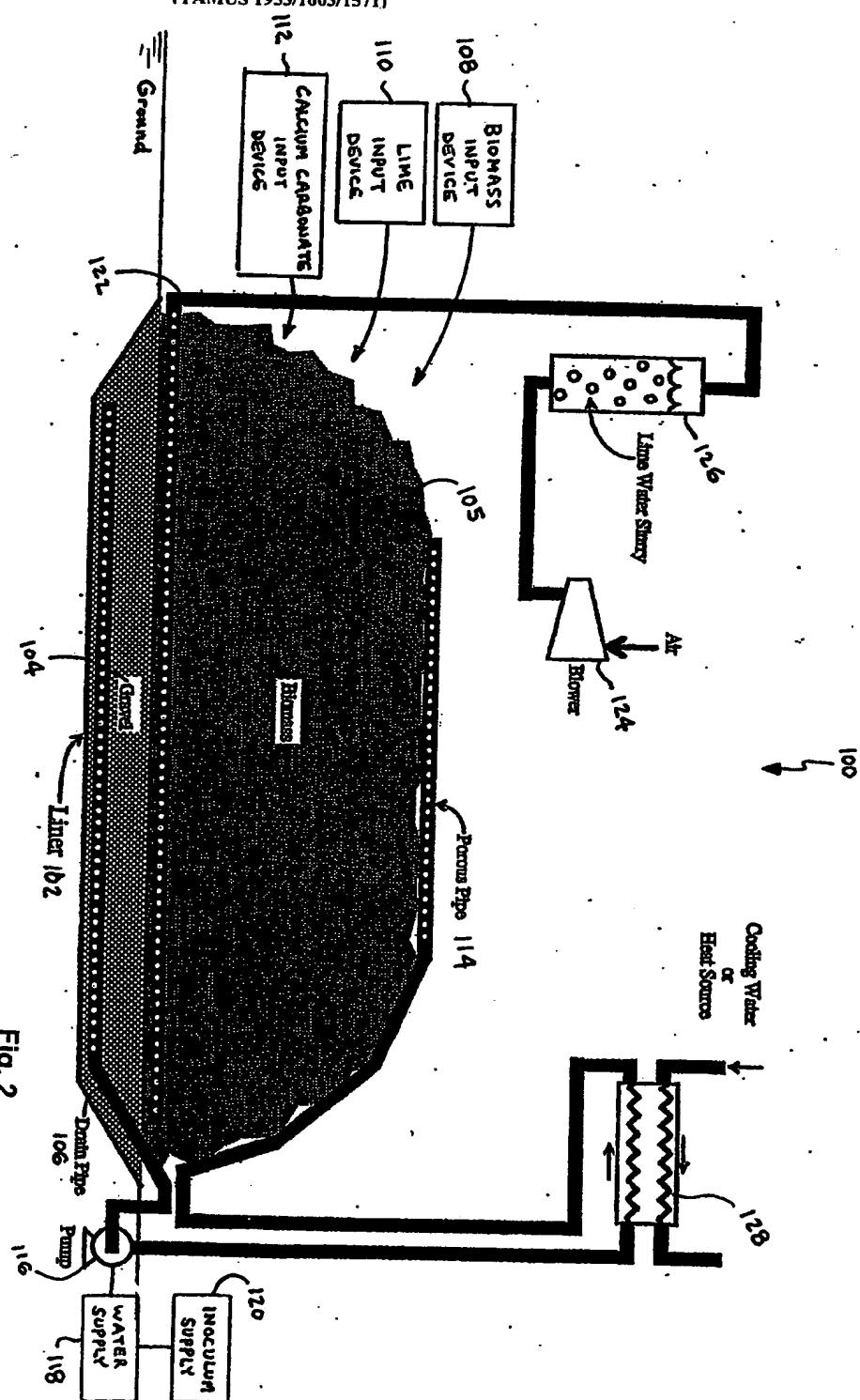


Fig. 2

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS      Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782      Page 3 of 51  
(TAMUS 1955/1603/1571)

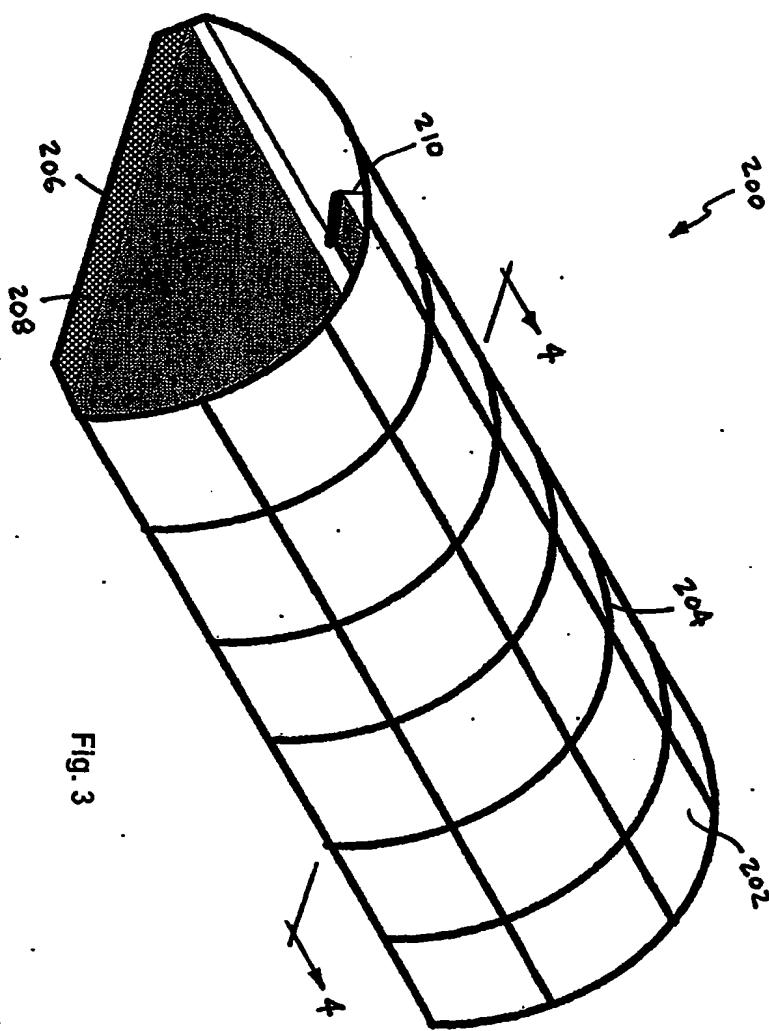


Fig. 3

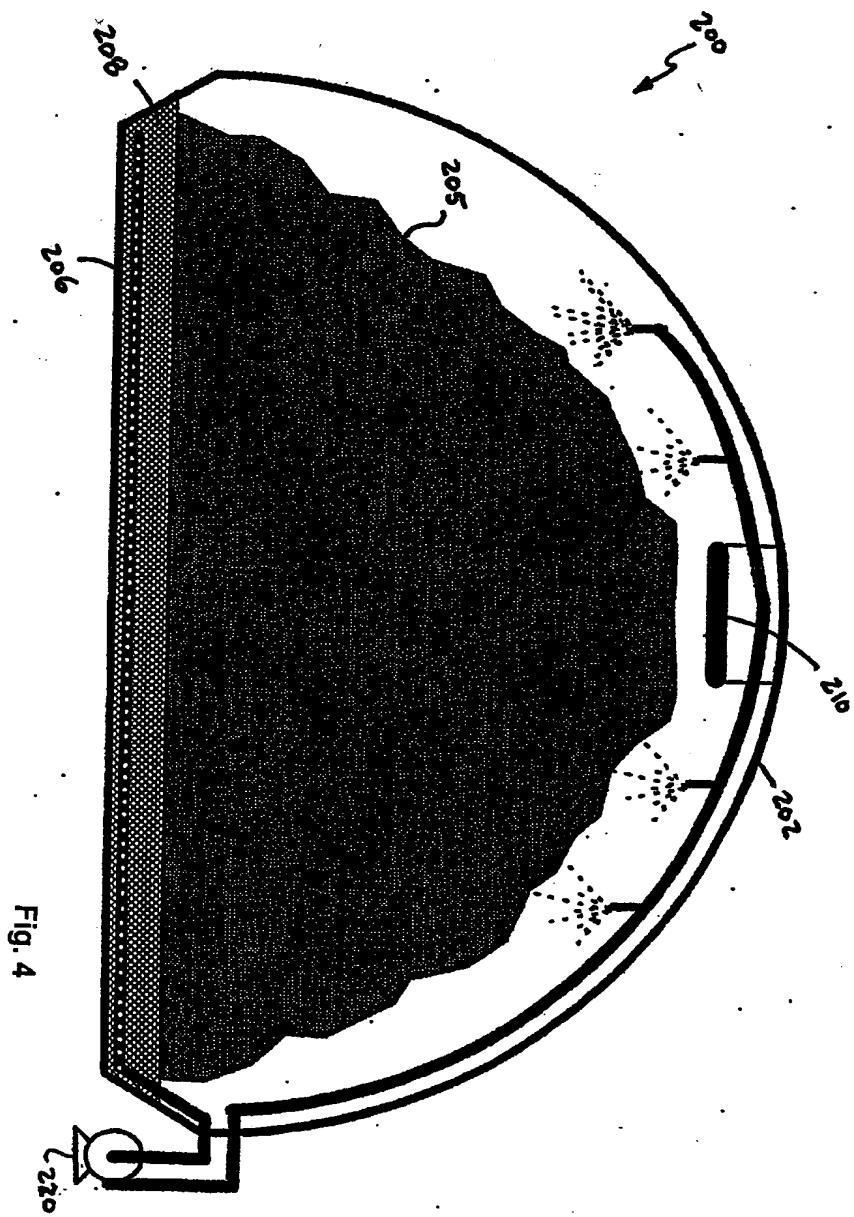


Fig. 4

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS      Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782      Page 5 of 51  
(TAMUS 1955/1603/1571)

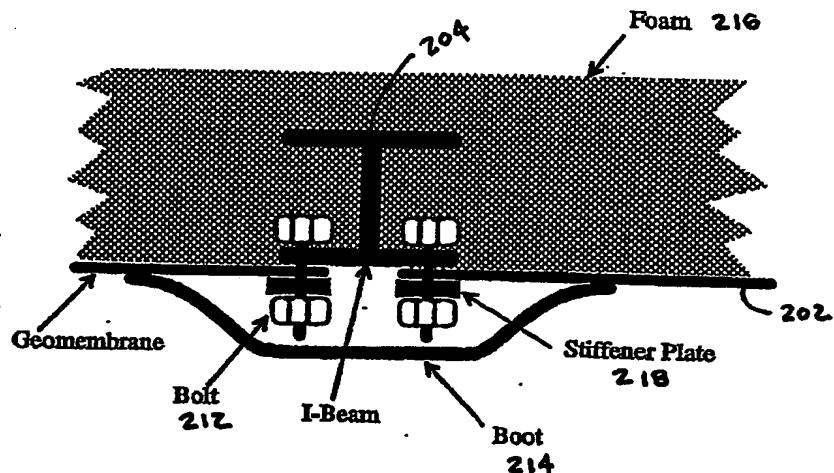


Fig. 5

**METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS**      Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782      Page 6 of 51  
(TAMUS 1955/1603/1571)

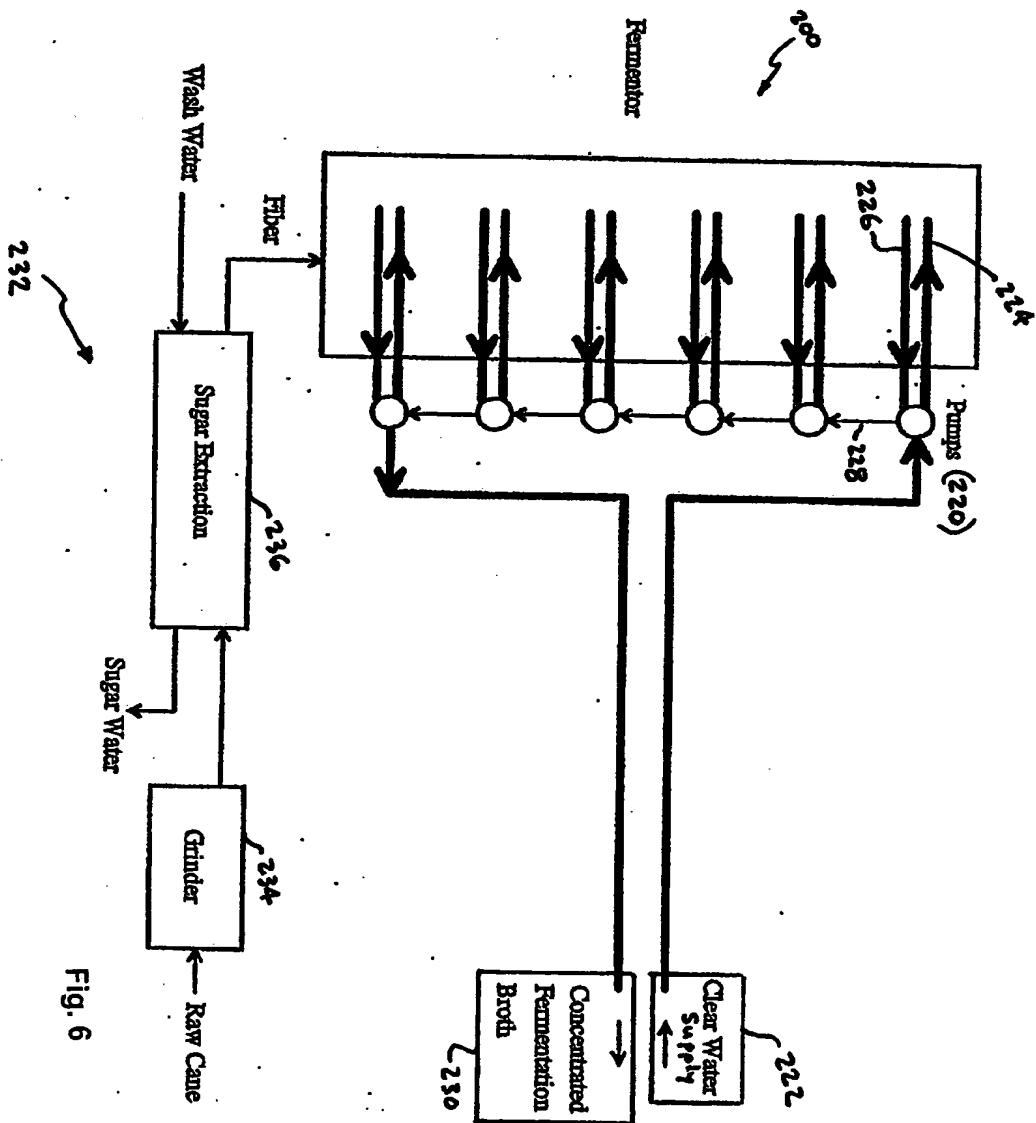
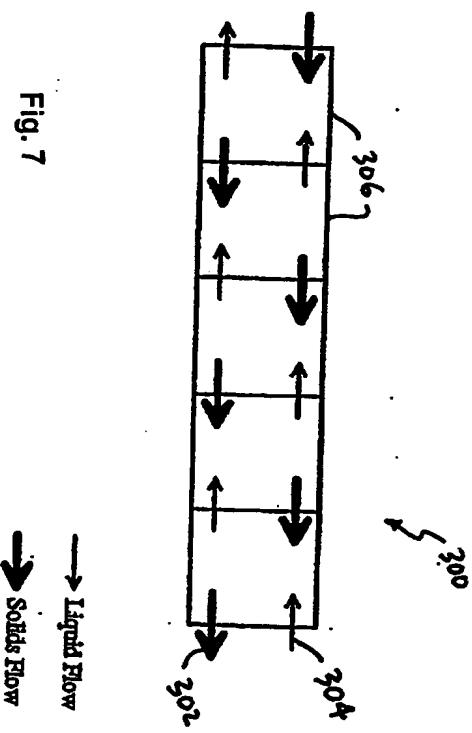


Fig.  
6

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS      Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782      Page 7 of 51  
(TAMUS 1955/1603/1571)



METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS      Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782      Page 8 of 51  
(TAMUS 1955/1603/1571)

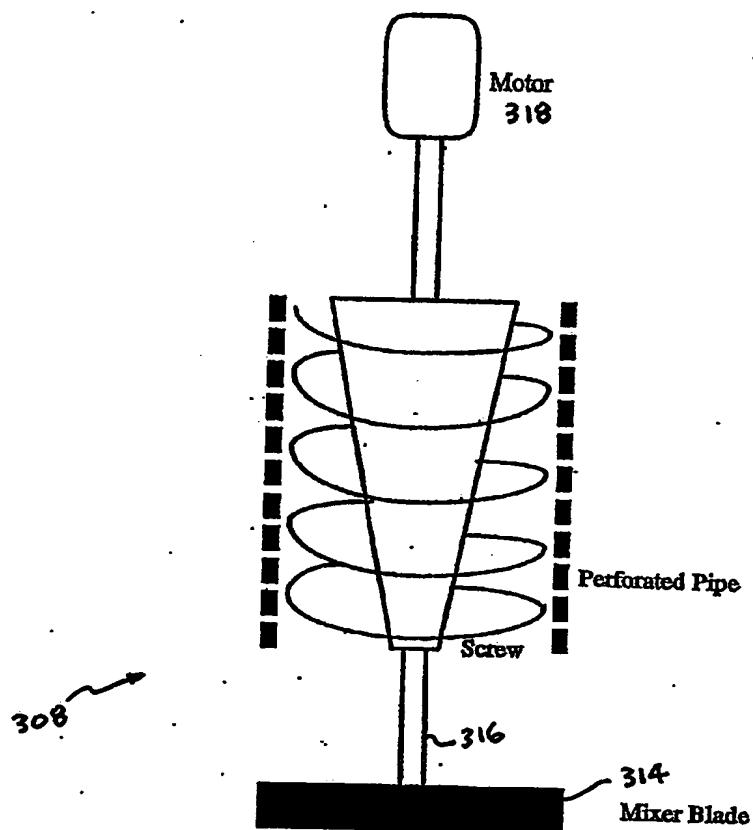
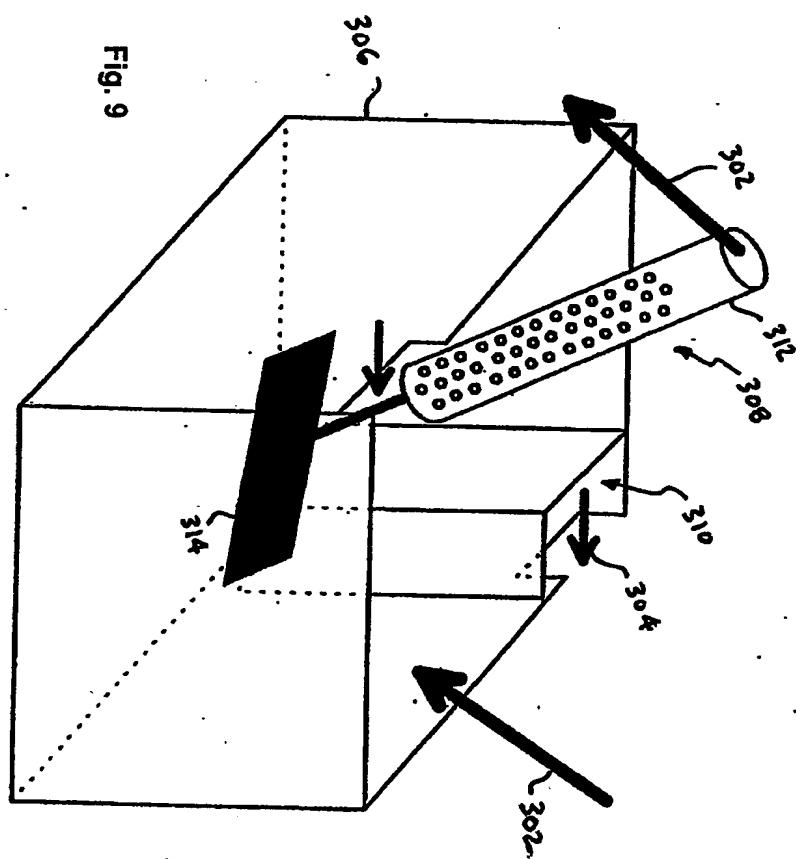


Fig. 8

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS      Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782      Page 9 of 51  
(TAMUS 1955/1603/1571)

Fig. 9



METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782 Page 10 of 51  
(TAMUS 1955/1603/1571)

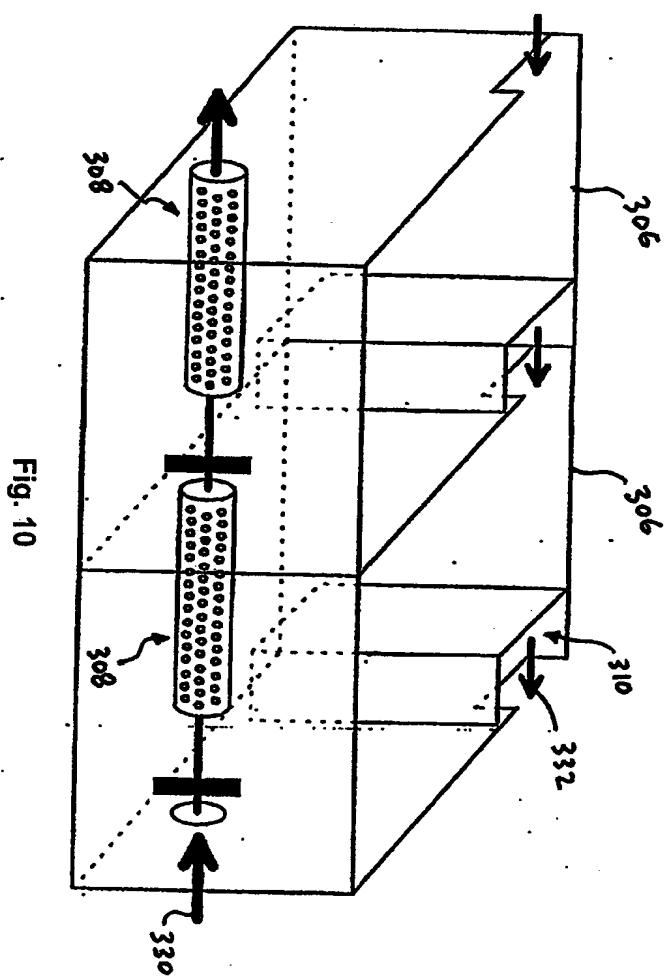


Fig. 10

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782 Page 11 of 51  
(TAMUS 1955/1603/1571)

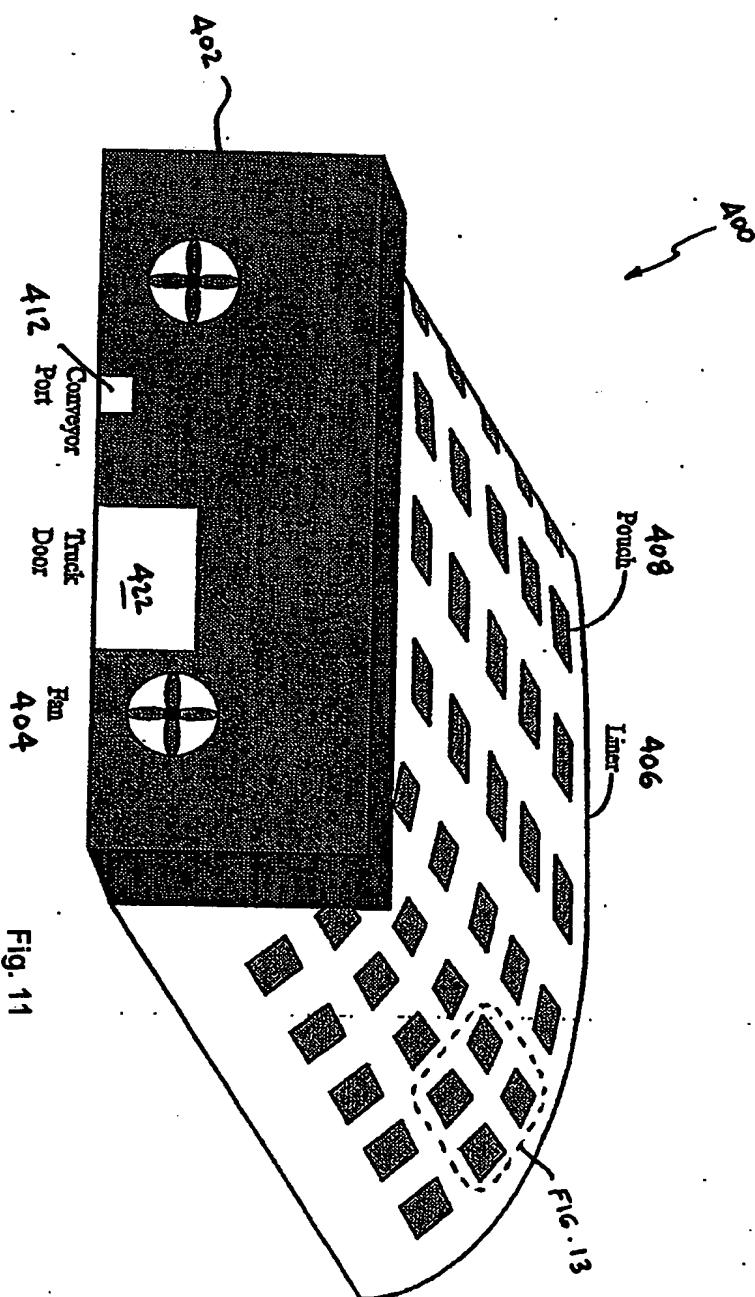


Fig. 11

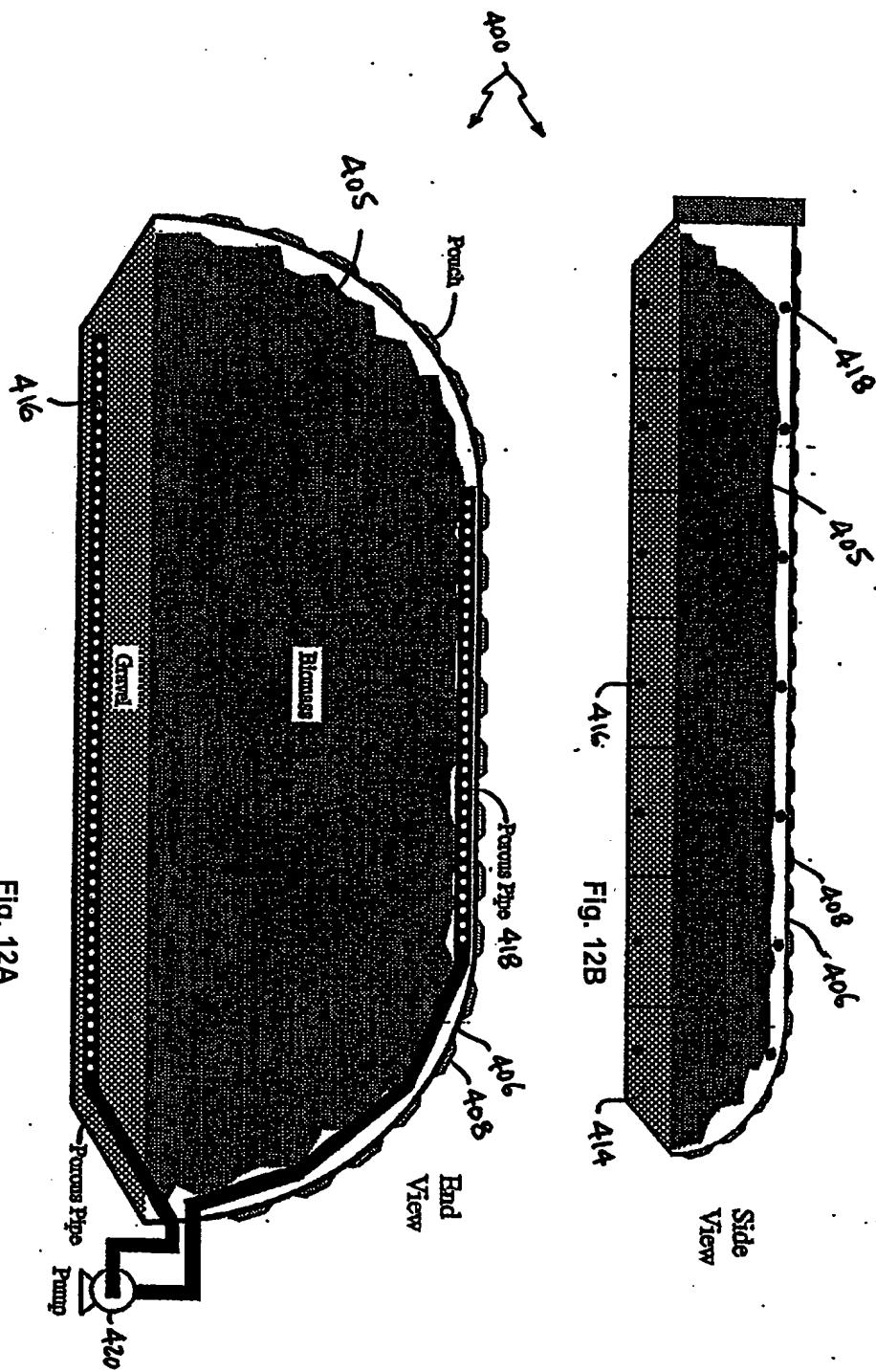
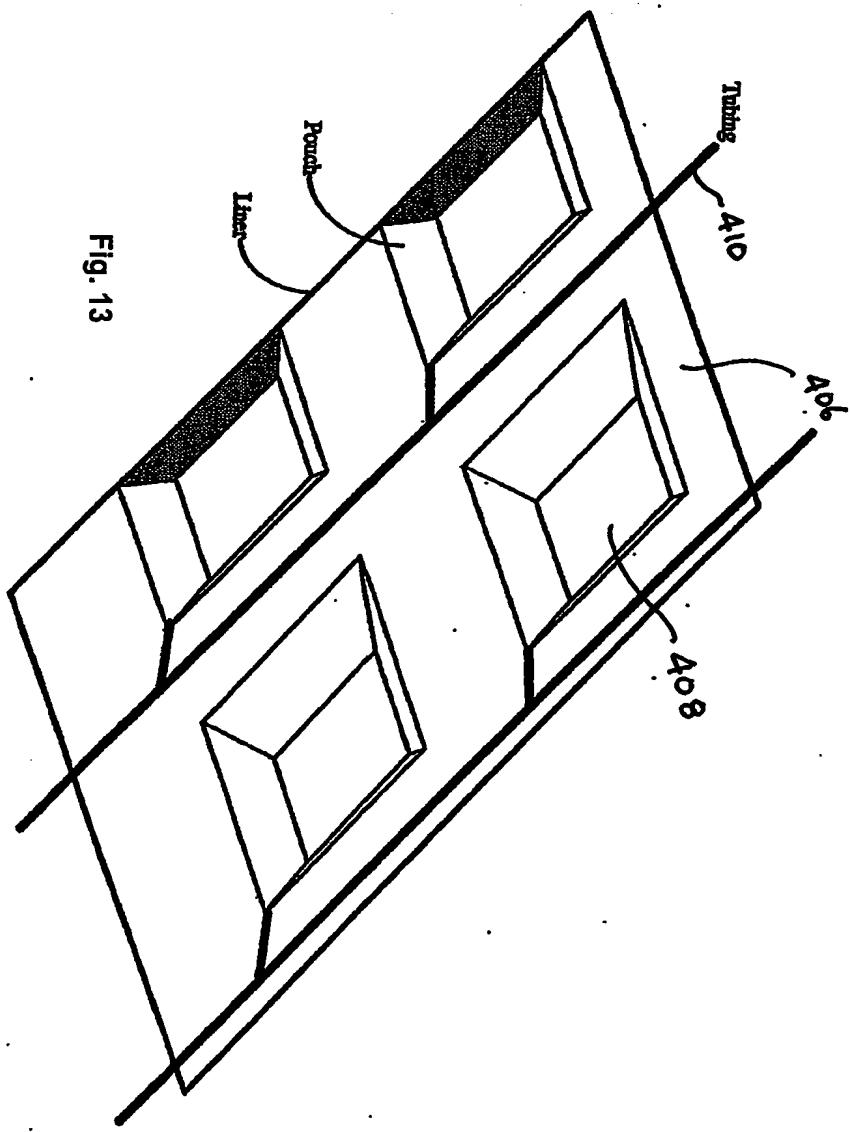


Fig. 12A

Fig. 12B

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS      Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782      Page 13 of 51  
(TAMUS 1955/1603/1571)

Fig. 13



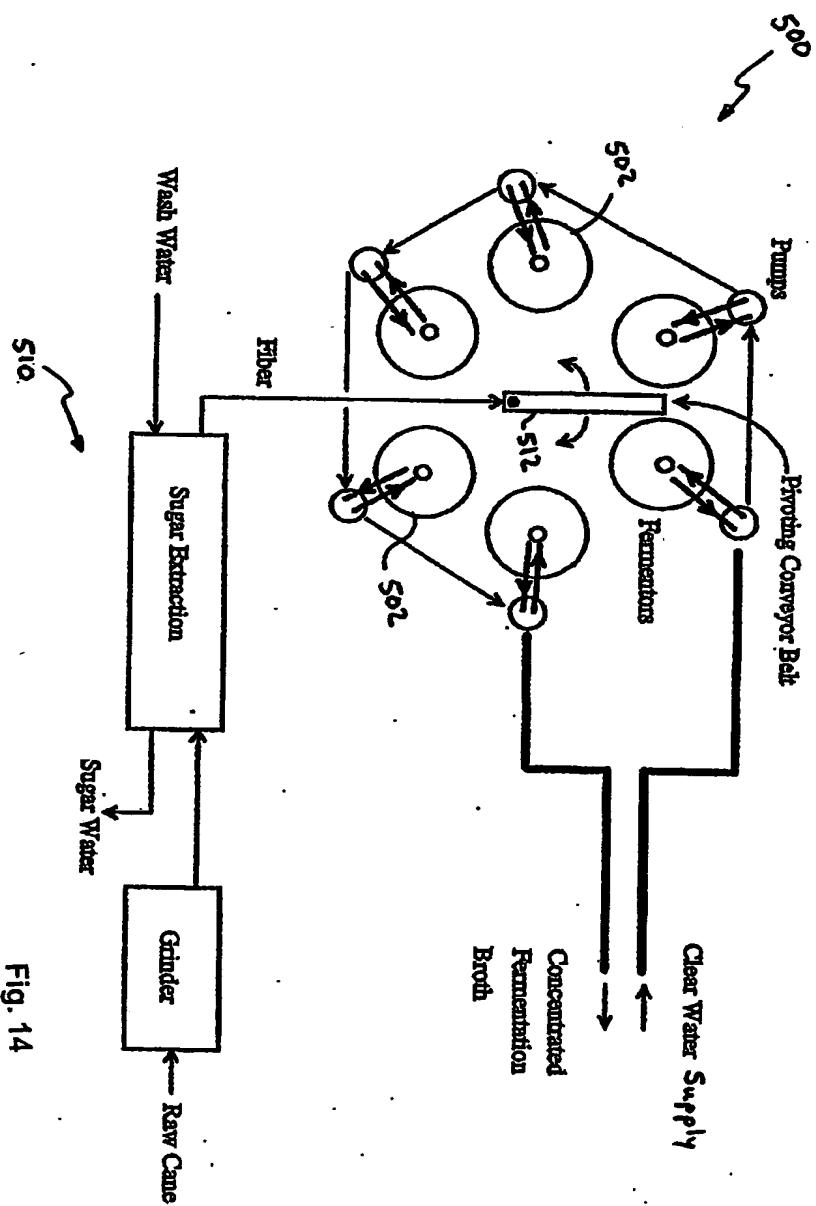


Fig. 14

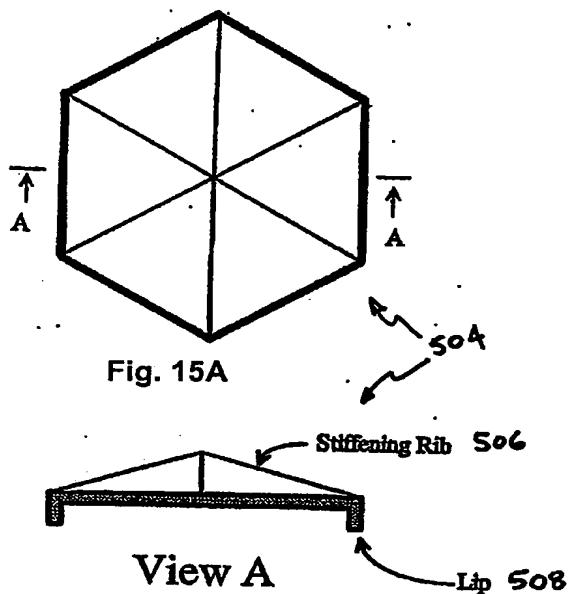


Fig. 15B

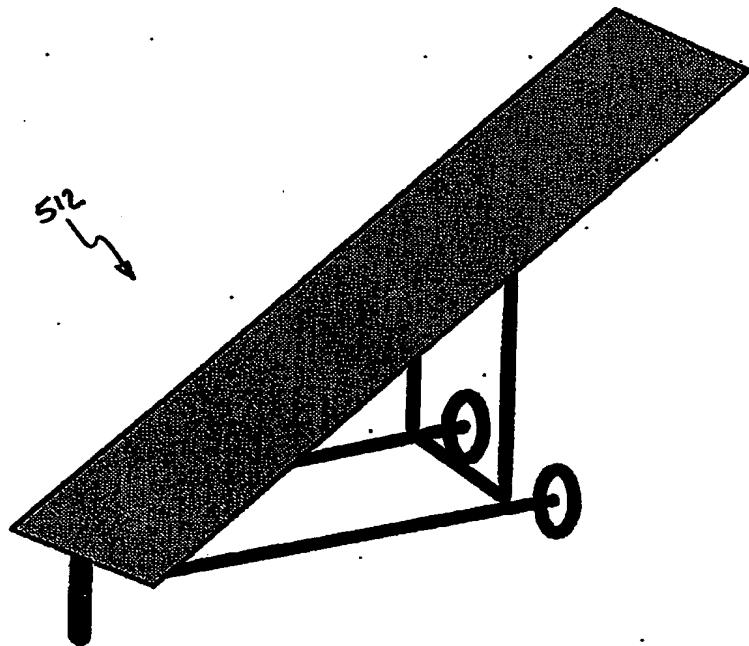


Fig. 16

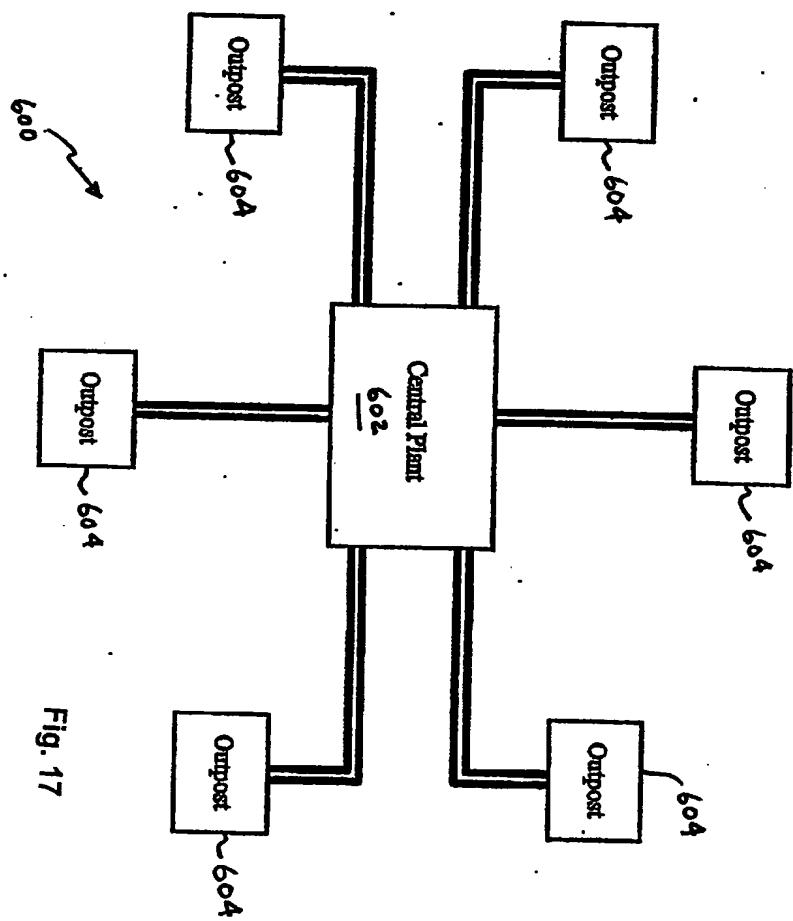


Fig. 17

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS      Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782      Page 18 of 51  
(TAMUS 1955/1603/1571)

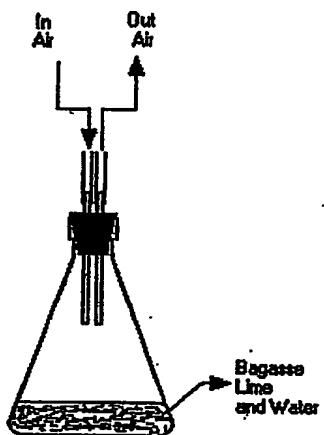


Fig. 18

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782 Page 19 of 51  
(TAMUS 1955/1603/1571)

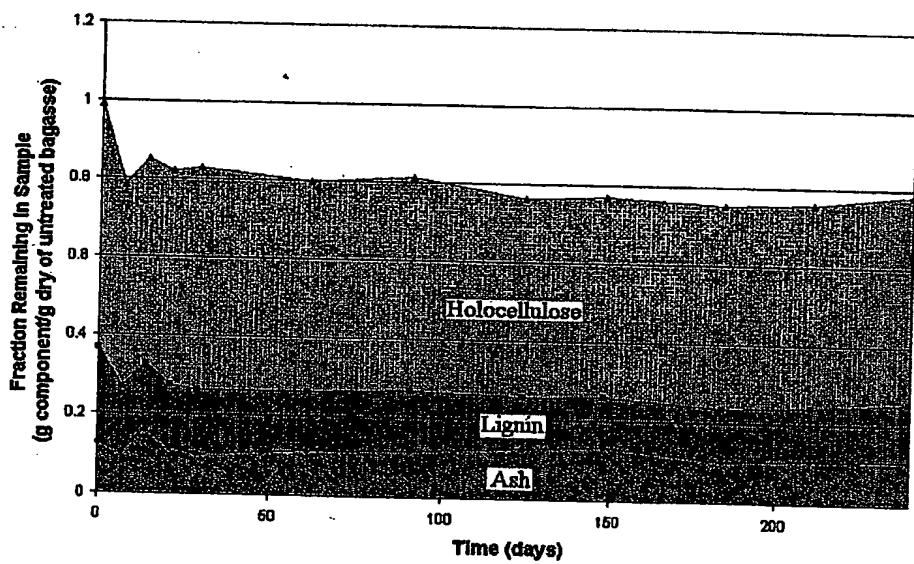


Fig. 19

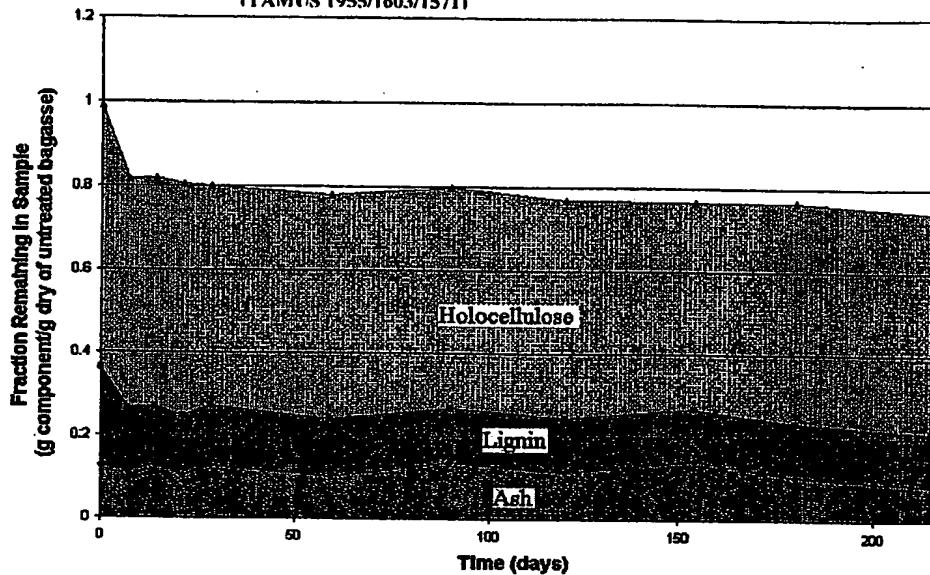


Fig. 20

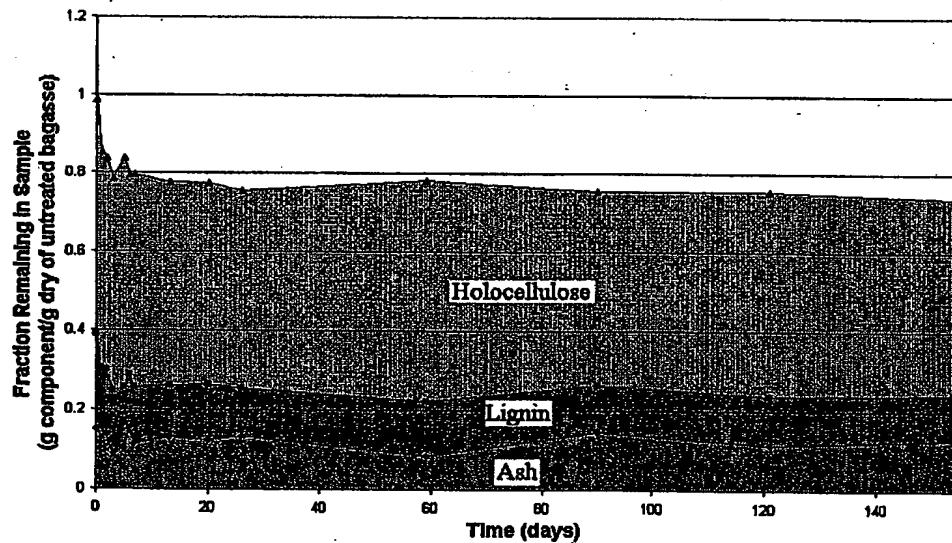
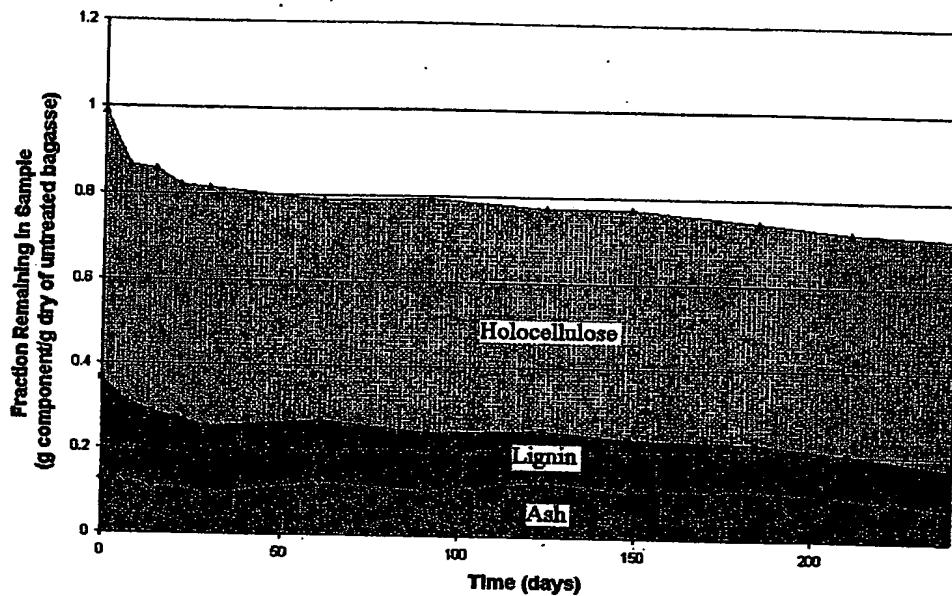
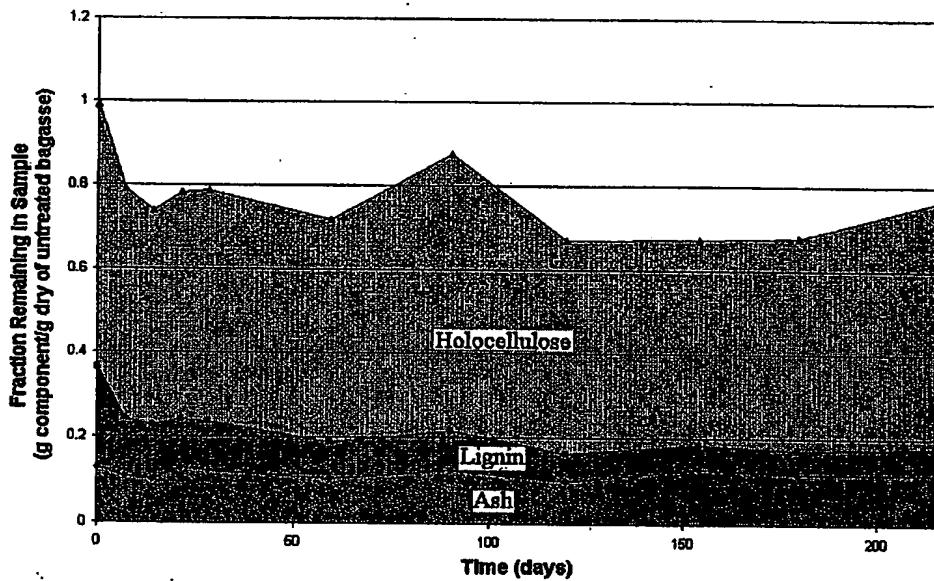


Fig. 21

**METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS** Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782 Page 21 of 51  
(TAMUS 1955/1603/1571)

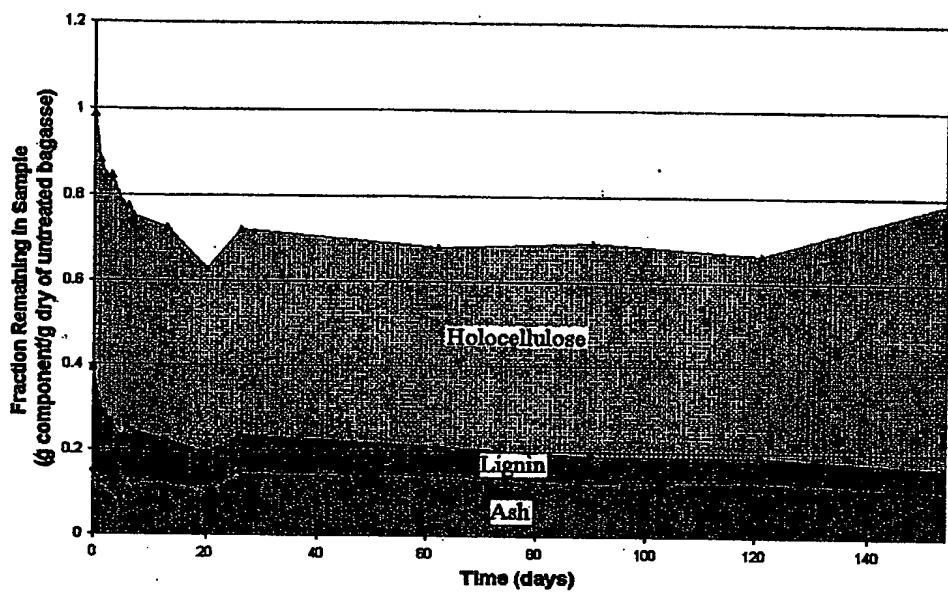


**Fig. 22**



**Fig. 23**

**METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS** Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575-0782 Page 22 of 51  
(TAMUS 1955/1603/1571)



**Fig. 24**

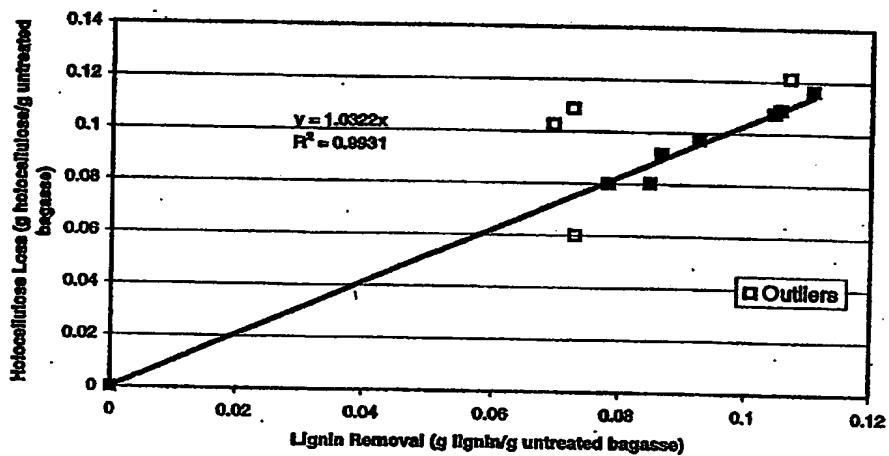


Fig. 25

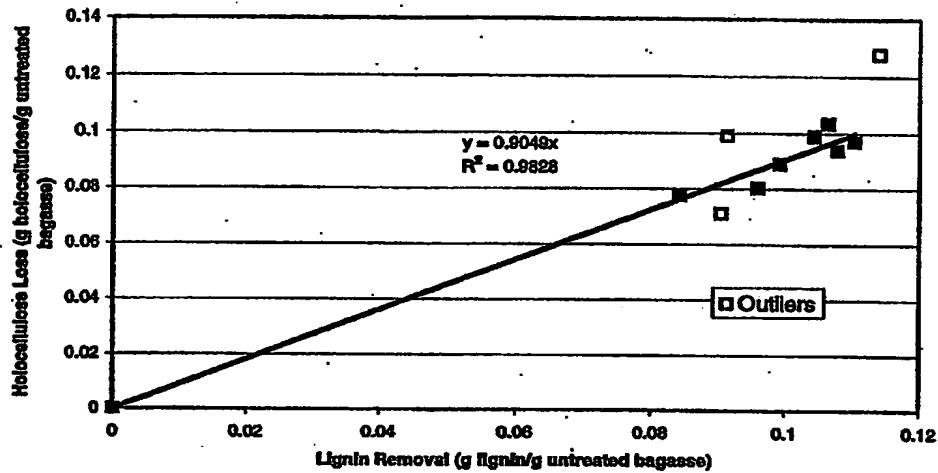


Fig. 26

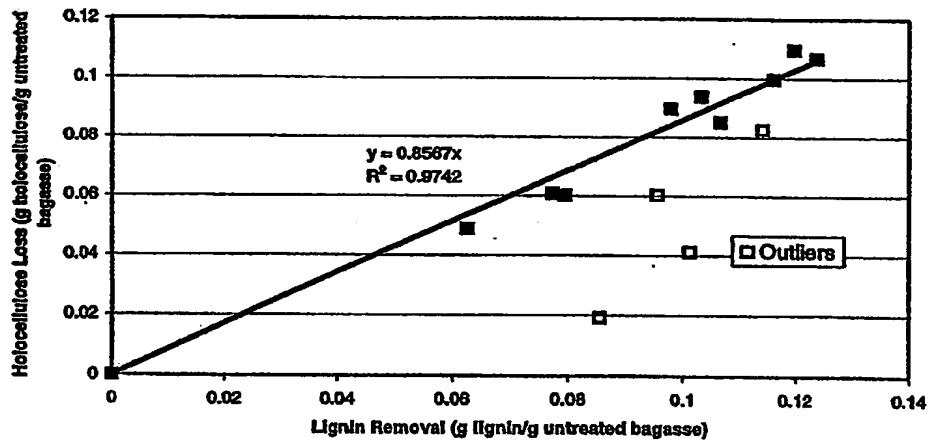


Fig. 27

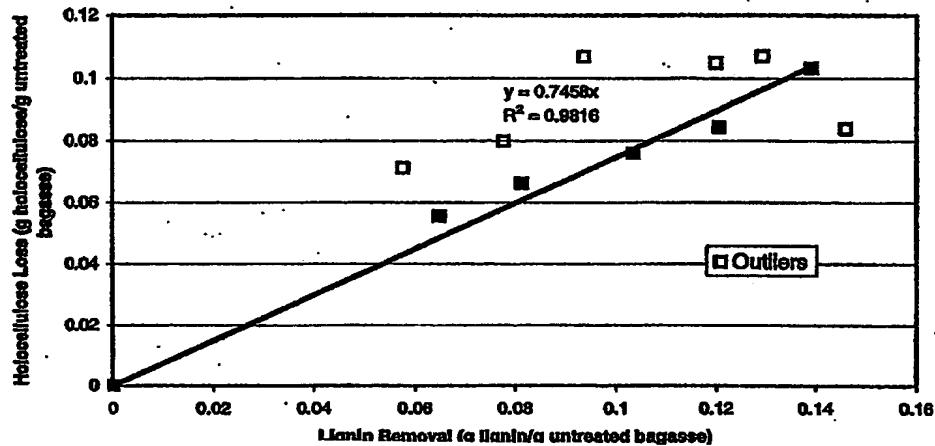


Fig. 28

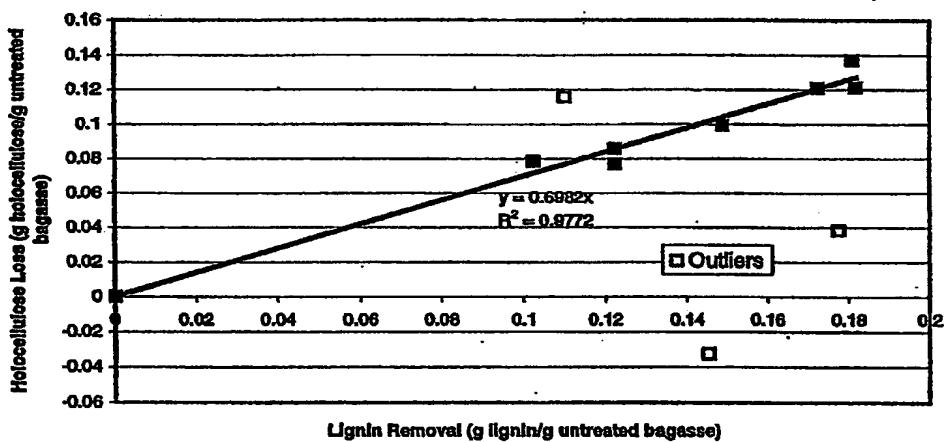


Fig. 29

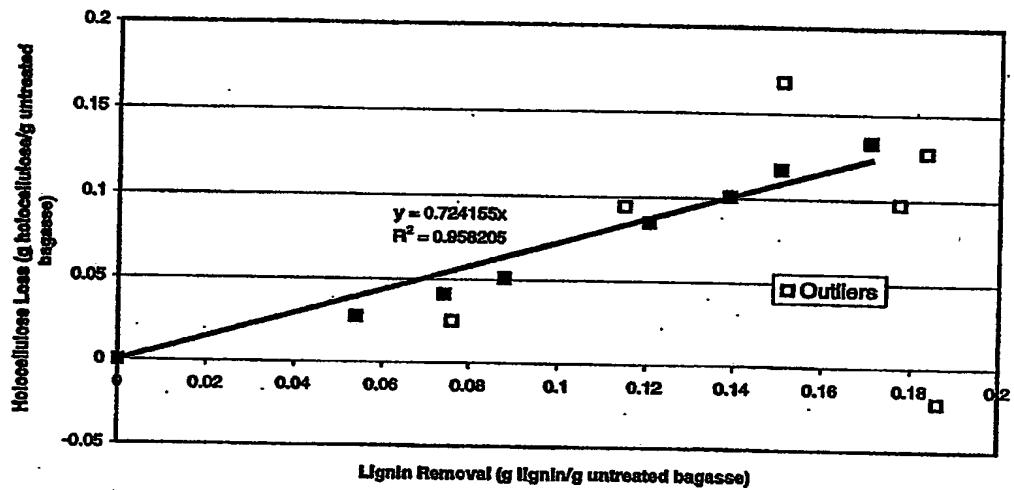


Fig. 30

METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS      Filed: 10/31/03  
Inventors: Mark Holtzapple et al.  
Attorney Docket: 017575.0782      Page 27 of 51  
(TAMUS 1955/1603/1571)

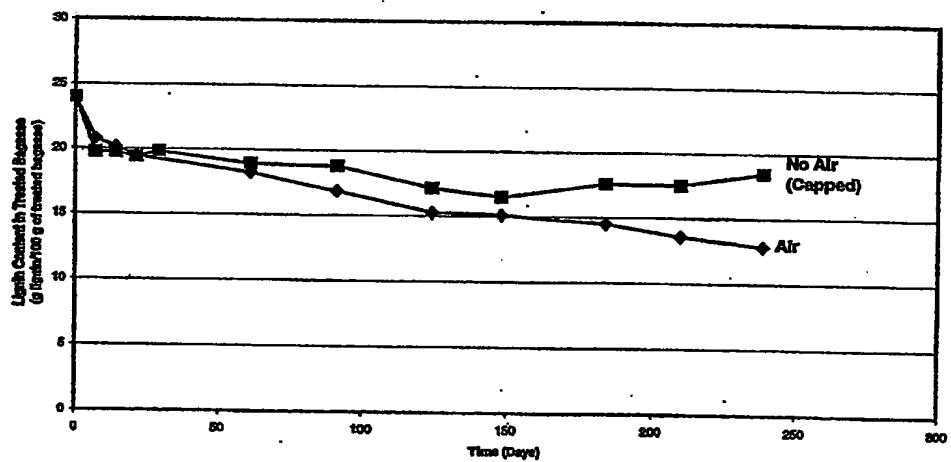


Fig. 31

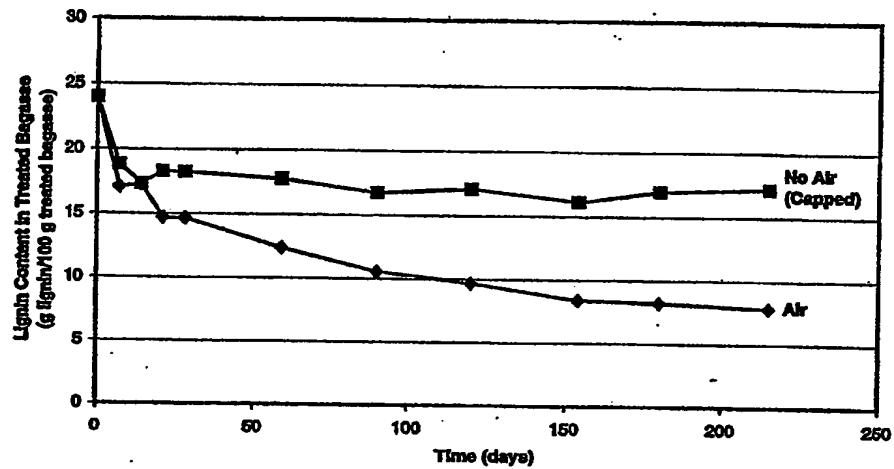


Fig. 32

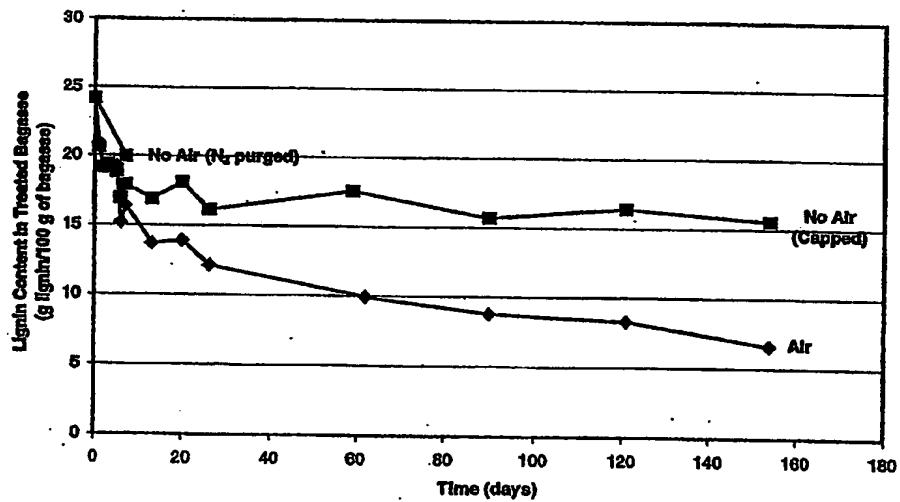


Fig. 33

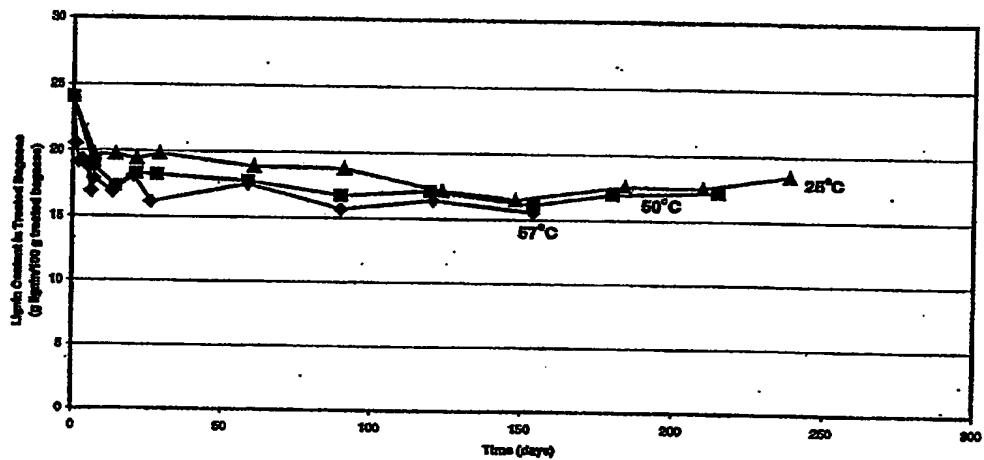


Fig. 34

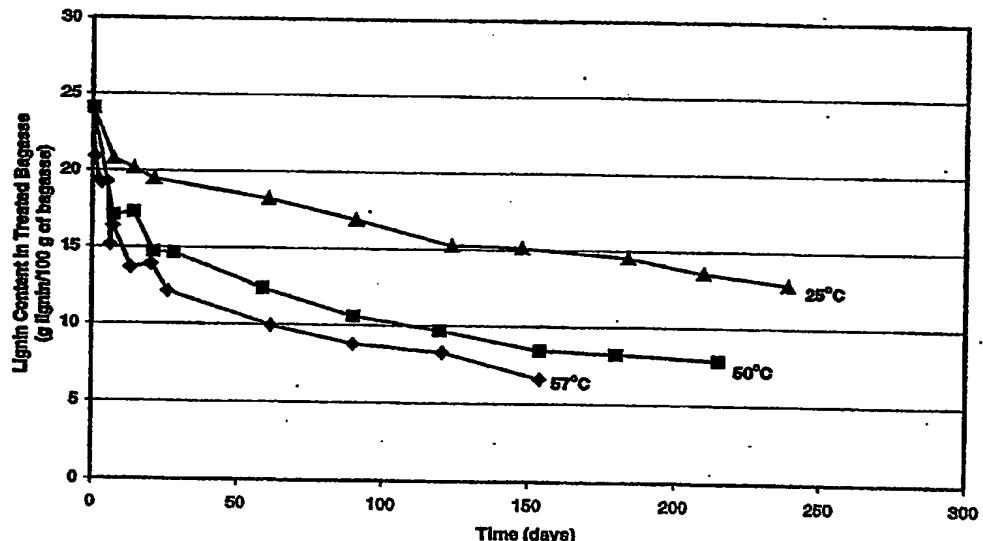


Fig. 35

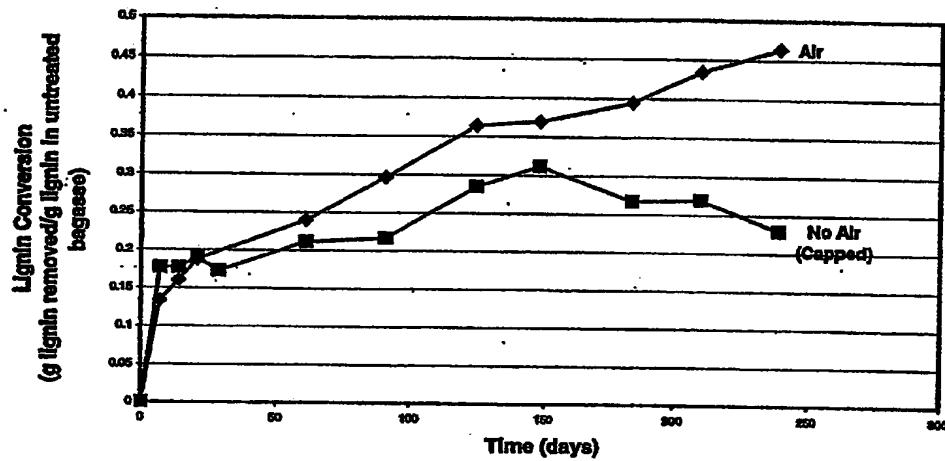


Fig. 36

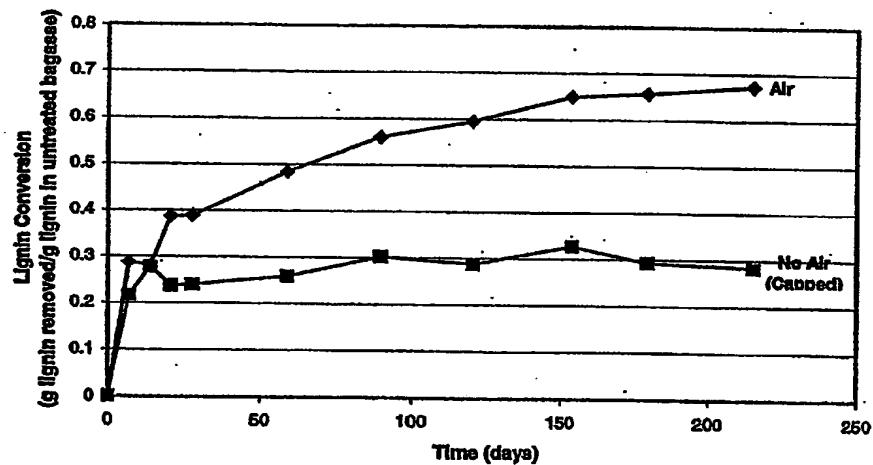


Fig. 37

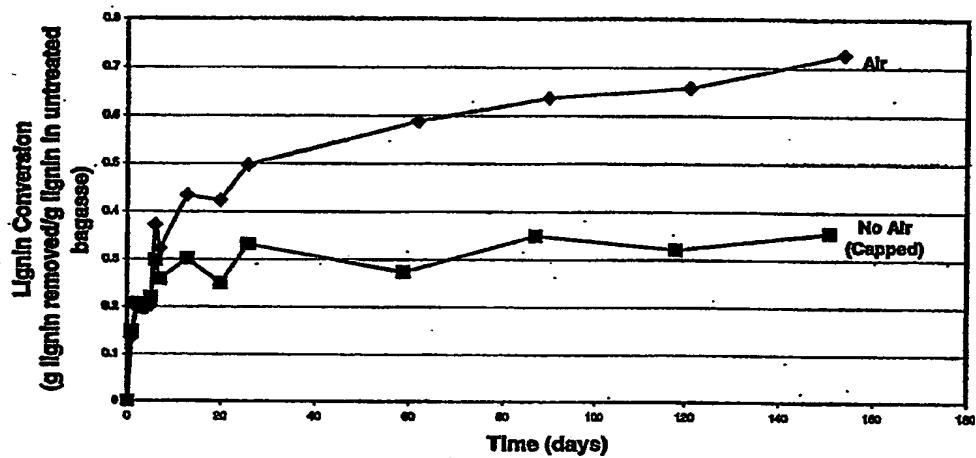


Fig. 38

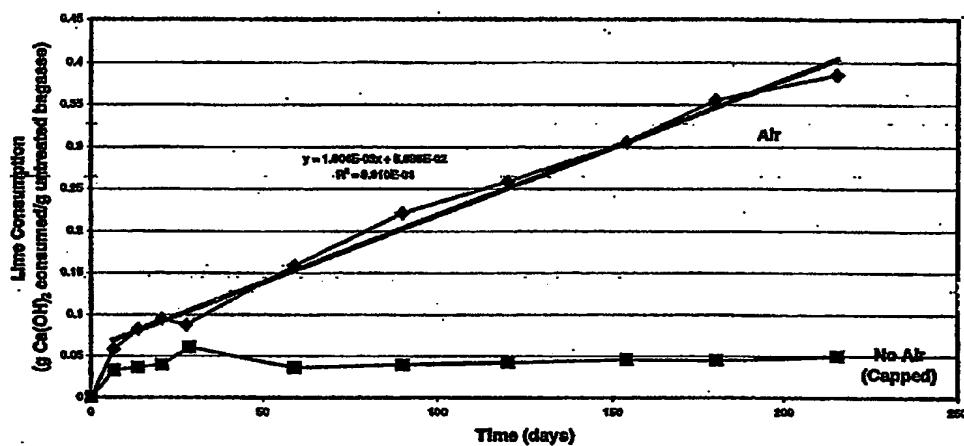


Fig. 39

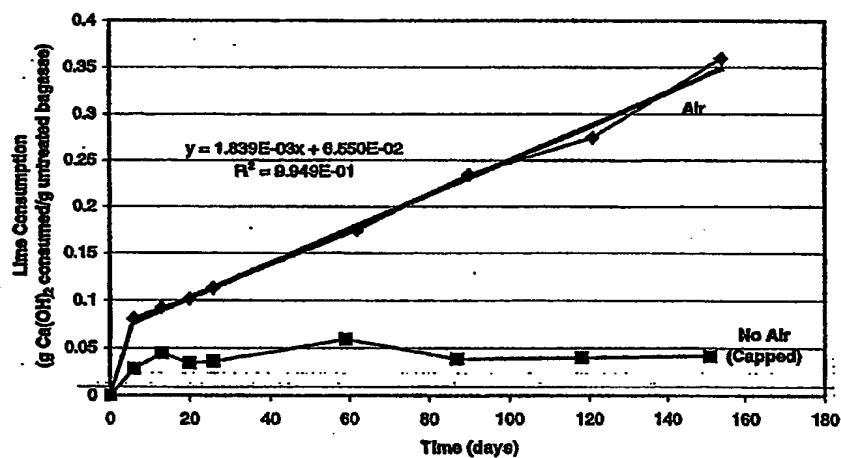


Fig. 40

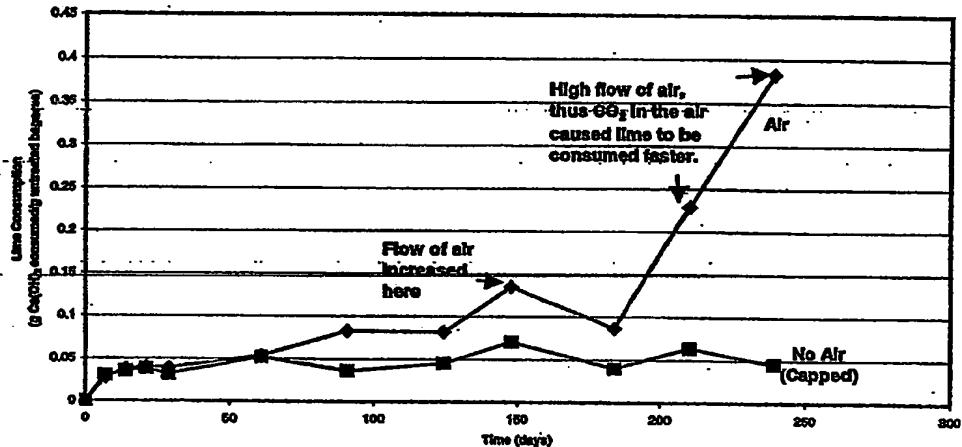


Fig. 41

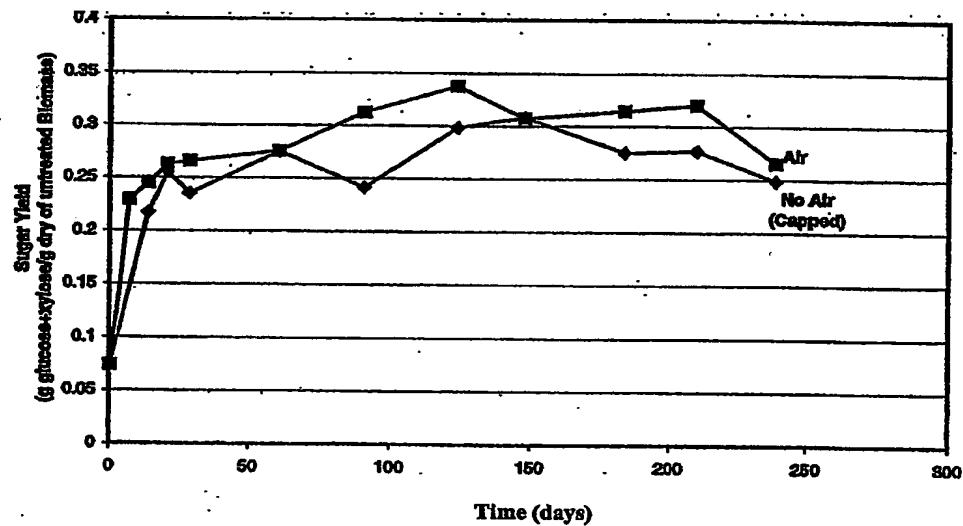


Fig. 42

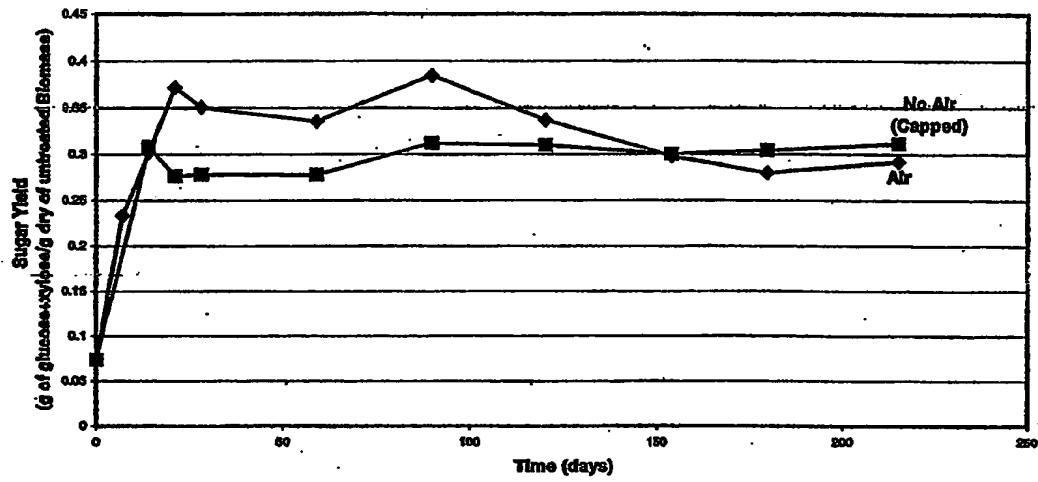


Fig. 43

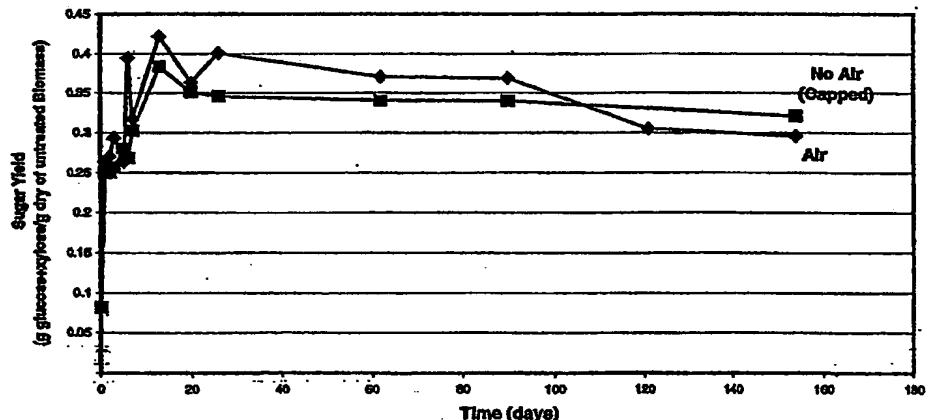


Fig. 44

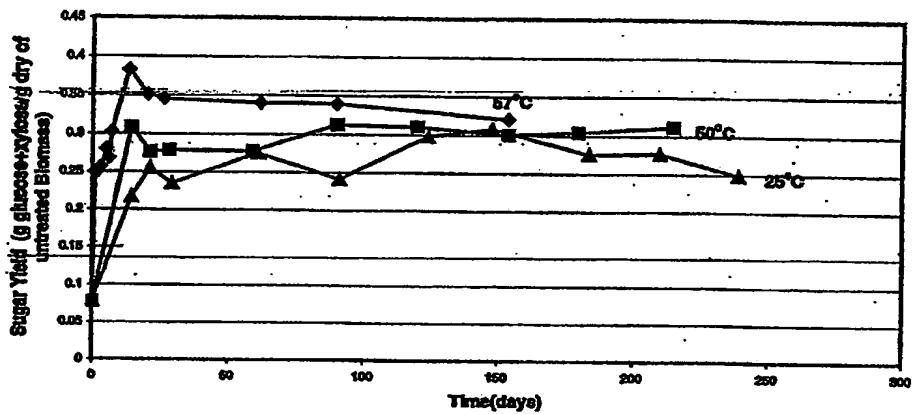


Fig. 45

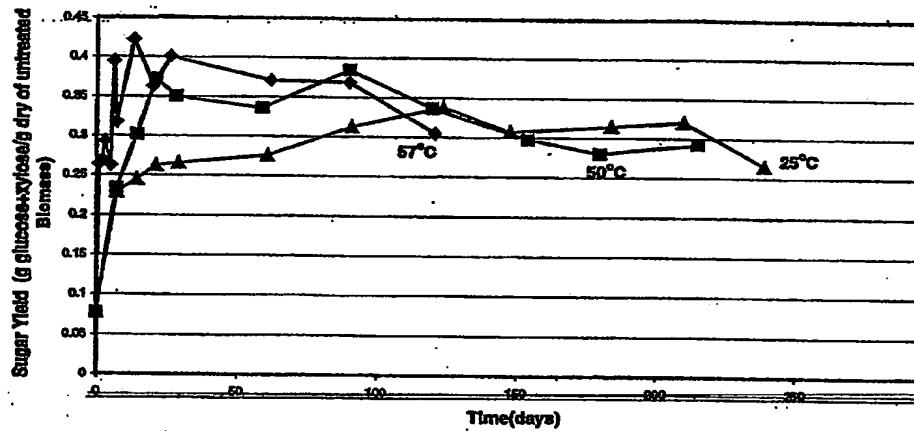


Fig. 46

**METHODS AND SYSTEMS FOR  
PRETREATMENT AND PROCESSING OF  
BIOMASS**  
Filed: 10/31/03  
Inventors: Mark Holtapple et al.  
Attorney Docket: 017575.0782 Page 37 of 51  
(TAMUS 1955/1603/1571)

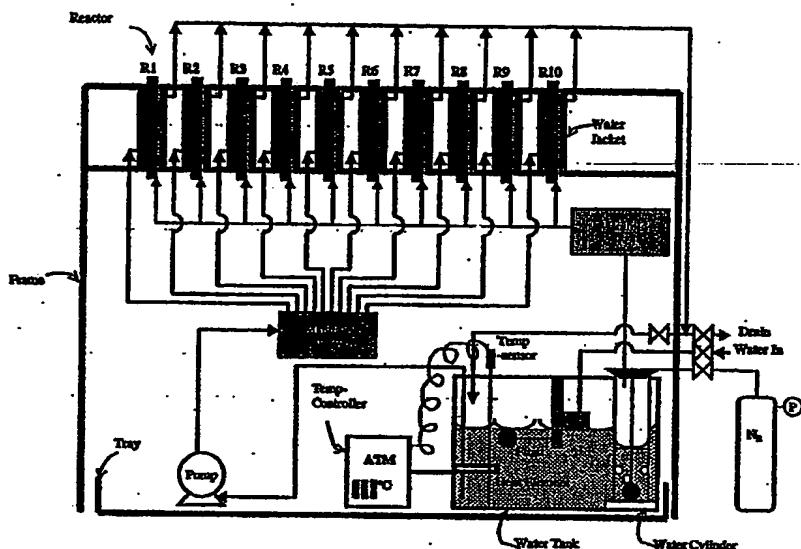


Fig. 47

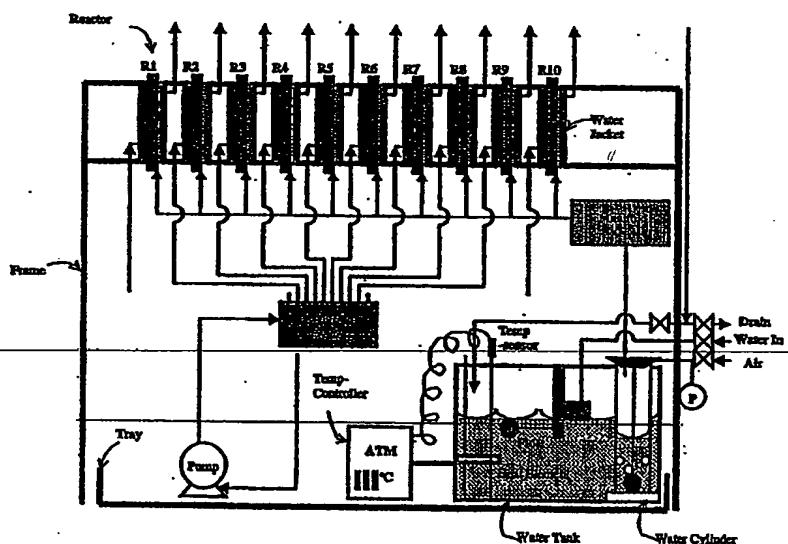


Fig. 48

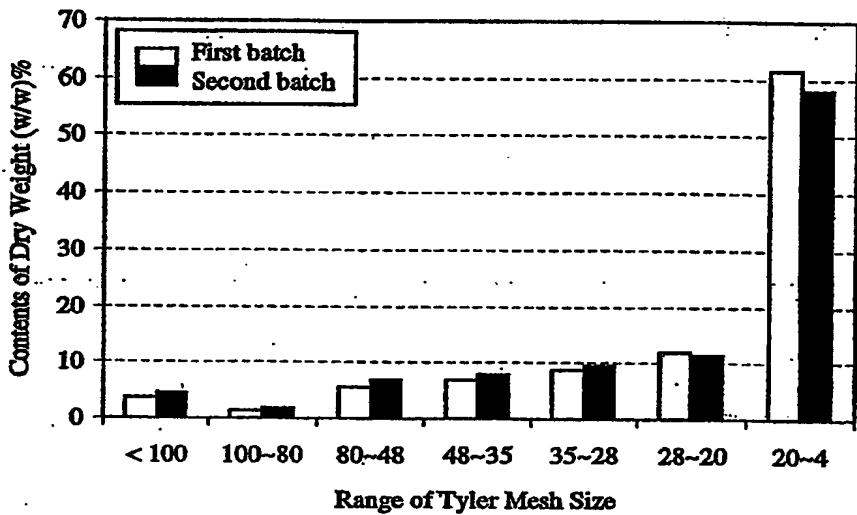


Fig. 49

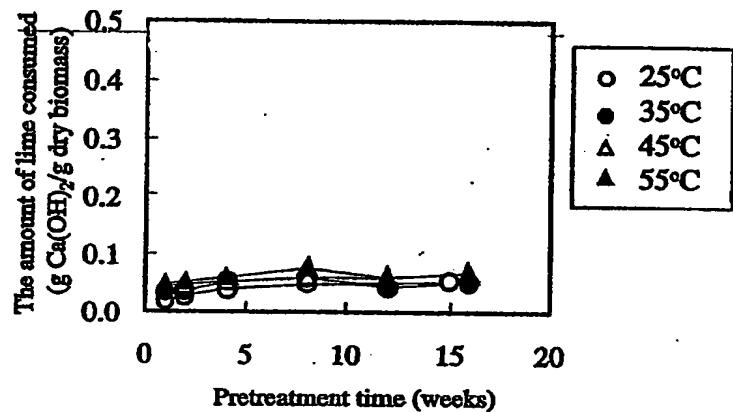


Fig. 50

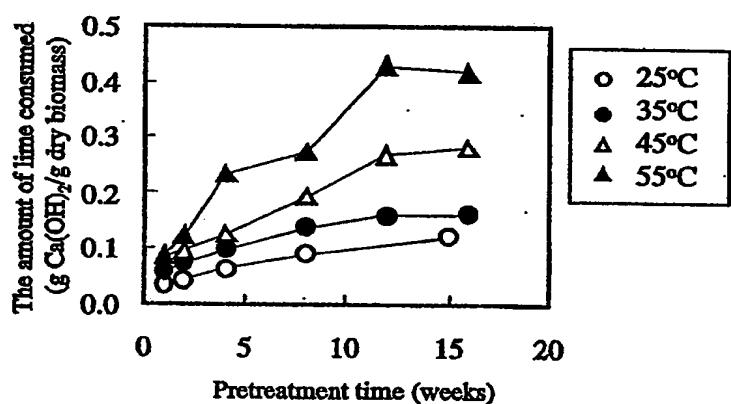


Fig. 51

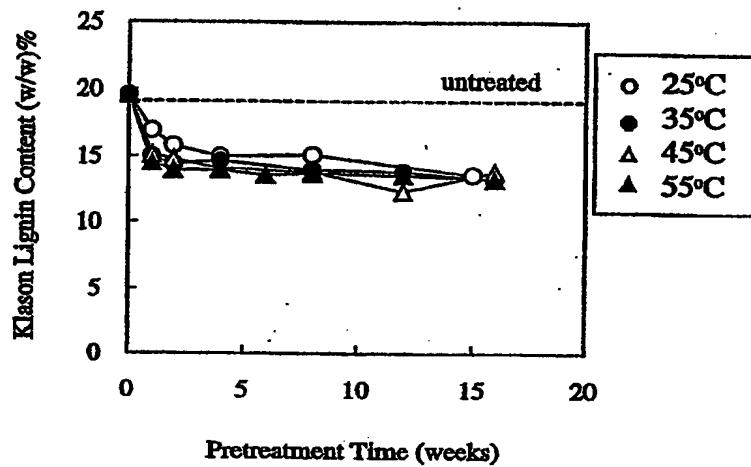


Fig. 52

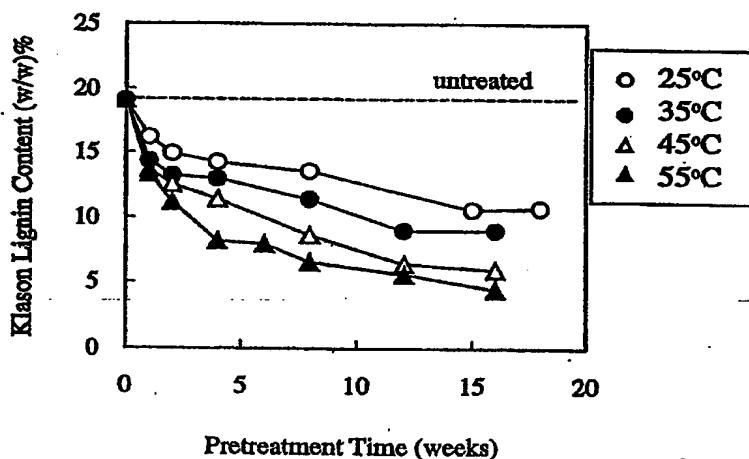


Fig. 53

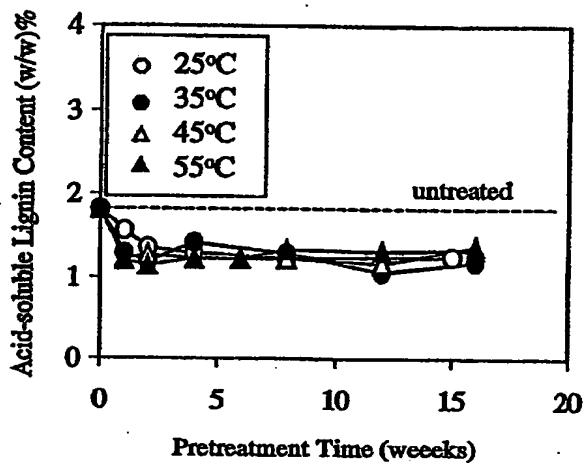


Fig. 54

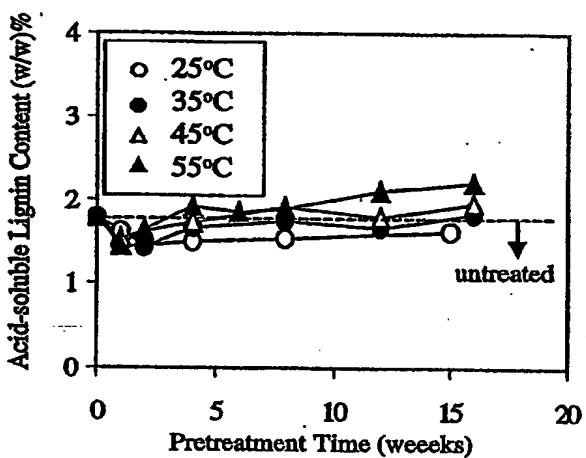


Fig. 55

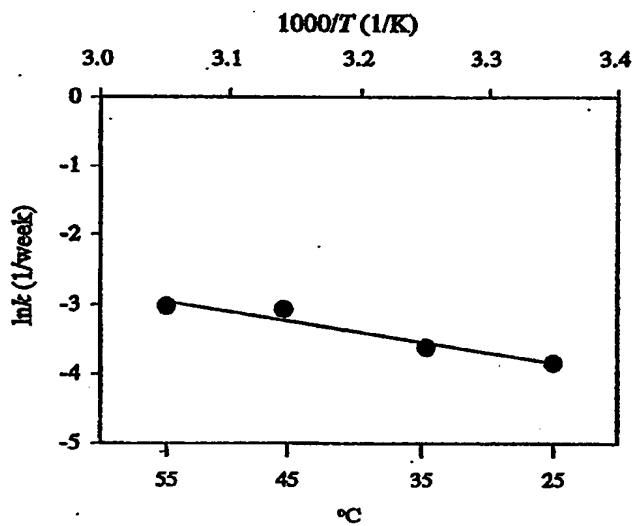


Fig. 56

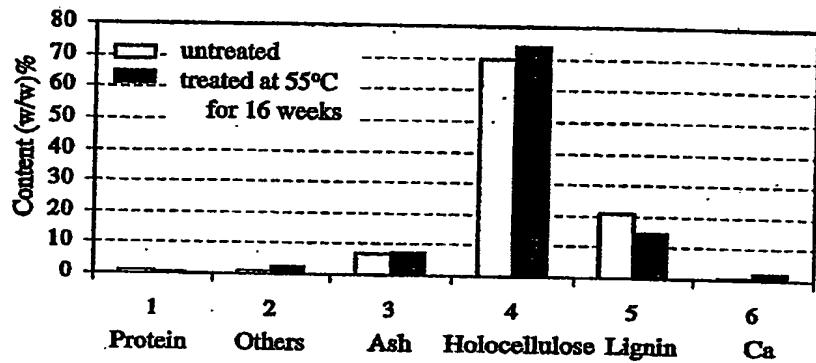


Fig. 57

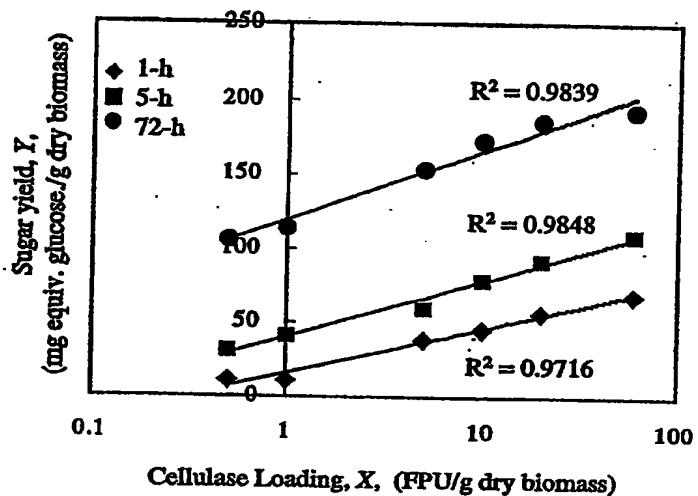


Fig. 58

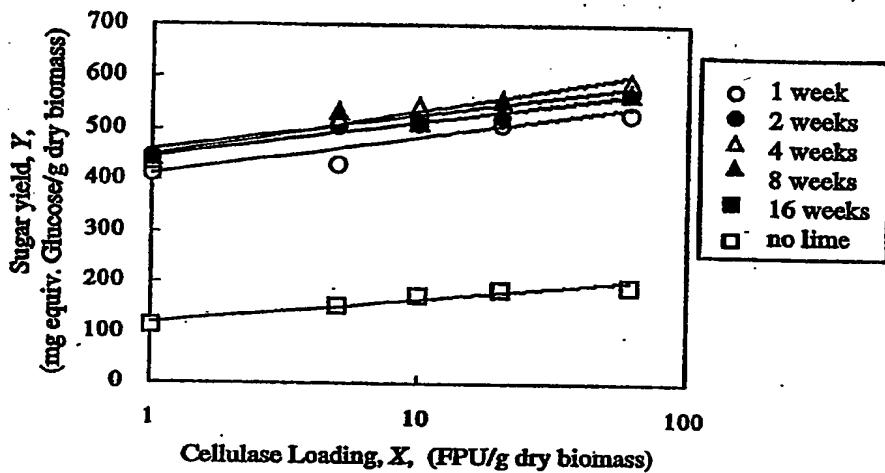


Fig. 59

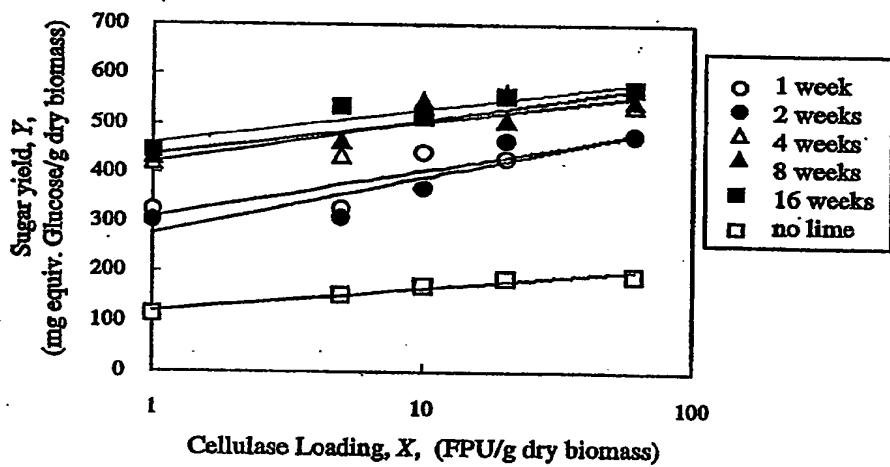


Fig. 60

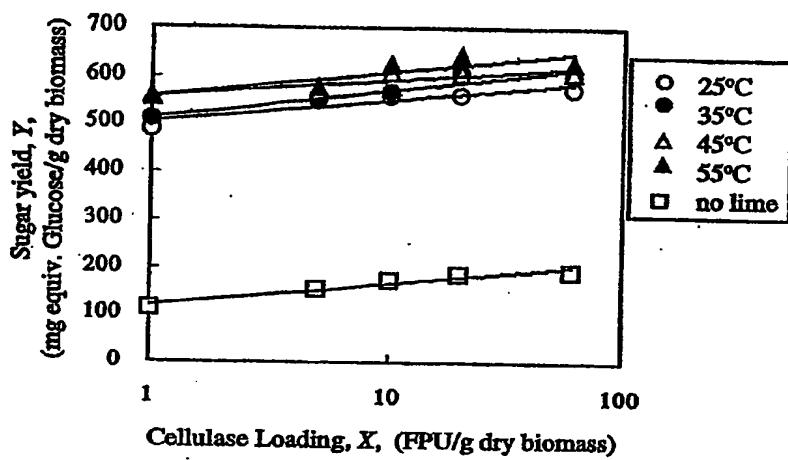
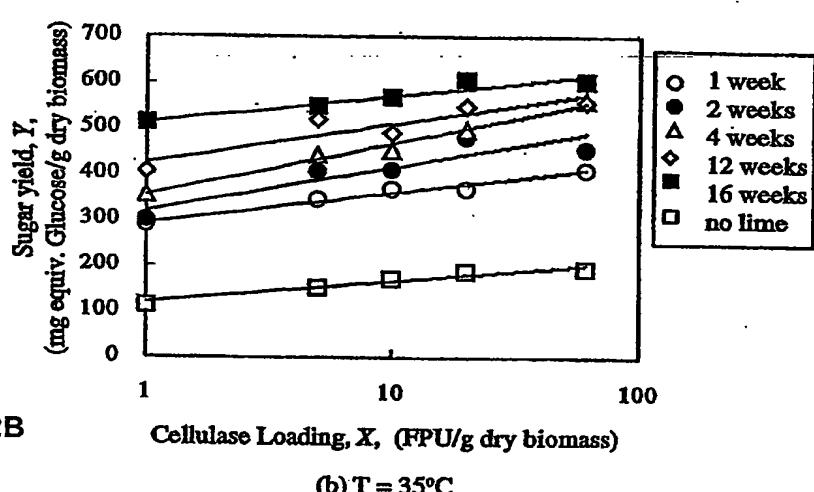
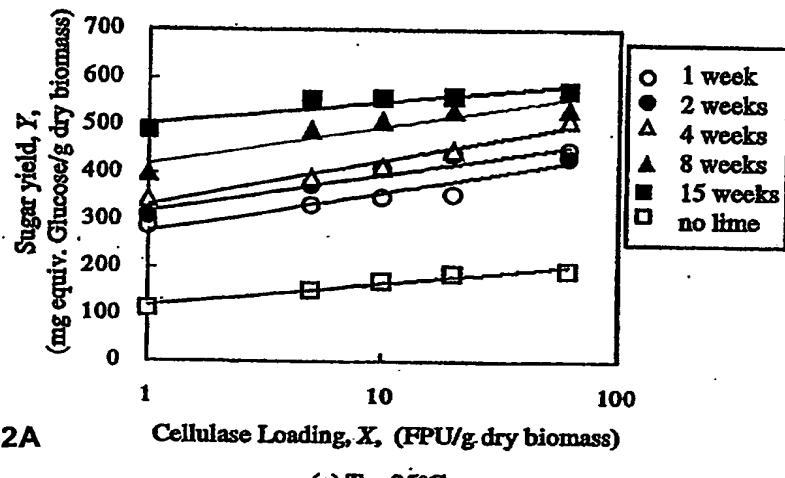


Fig. 61



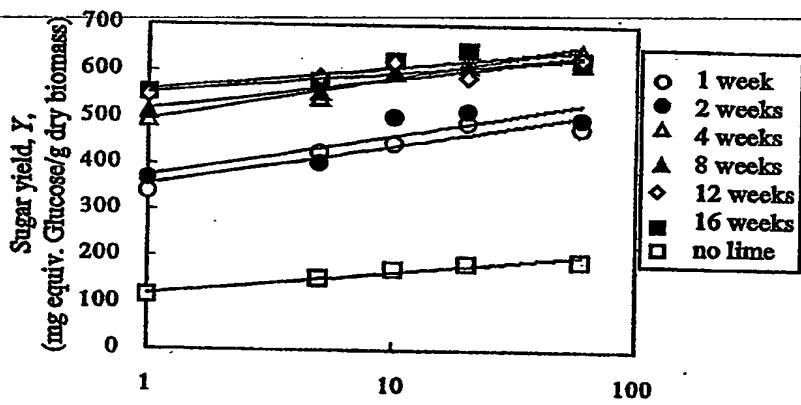
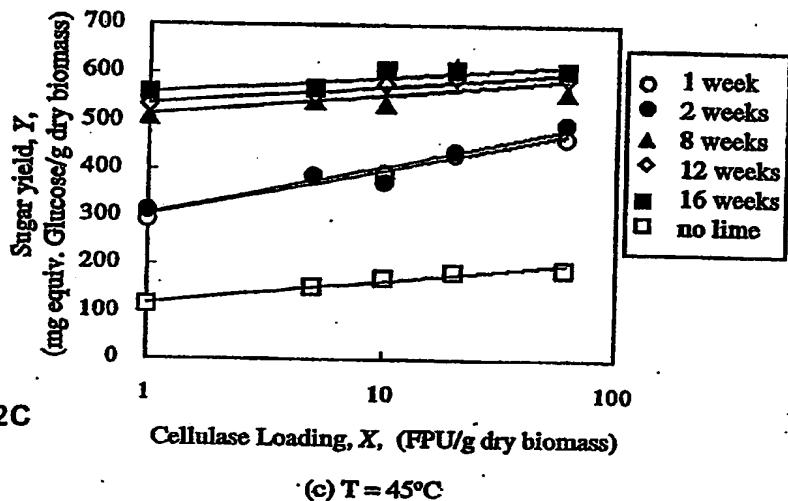


Fig. 62D

(d)  $T = 55^\circ\text{C}$

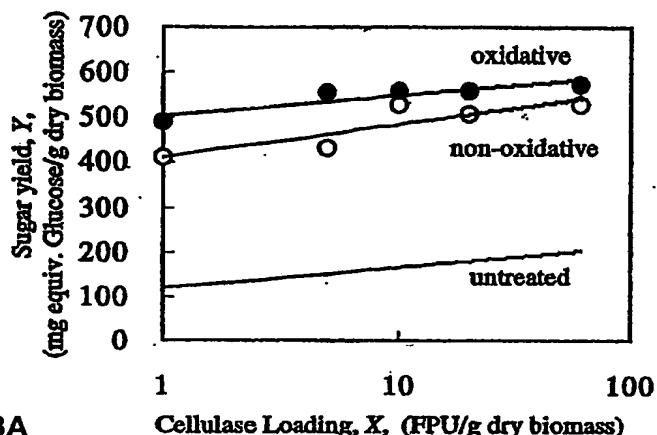


Fig. 63A

Cellulase Loading, X, (FPU/g dry biomass)

(a)  $T = 25^\circ\text{C}$ .

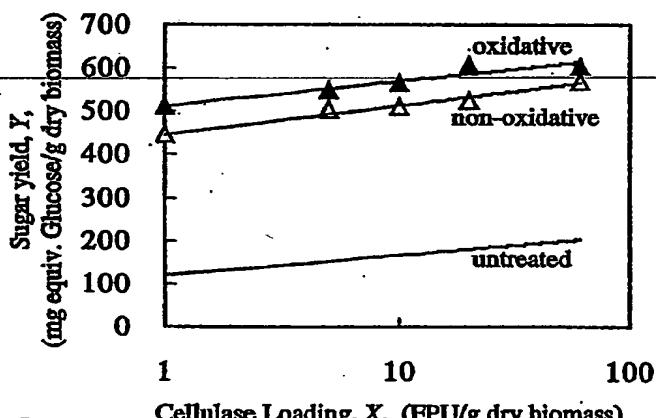


Fig. 63B

Cellulase Loading, X, (FPU/g dry biomass)

(b)  $T = 35^\circ\text{C}$

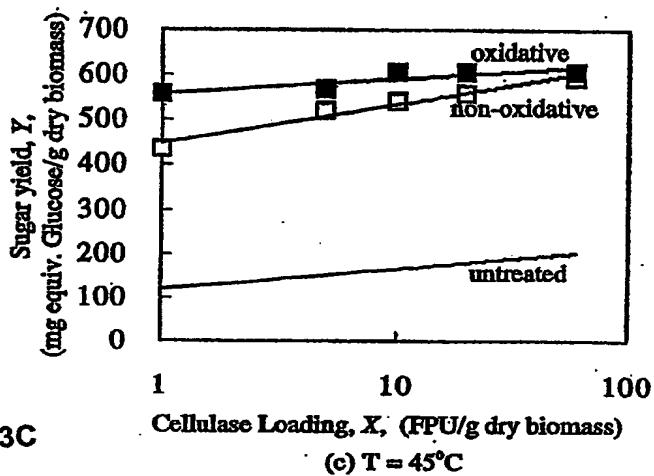


Fig. 63C

(c)  $T = 45^\circ\text{C}$

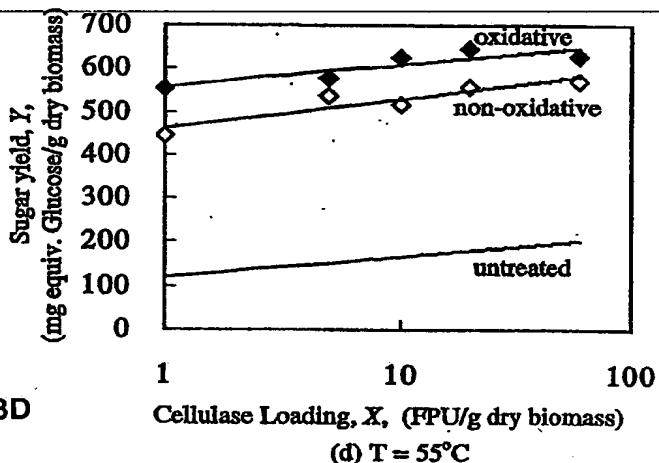


Fig. 63D

(d)  $T = 55^\circ\text{C}$

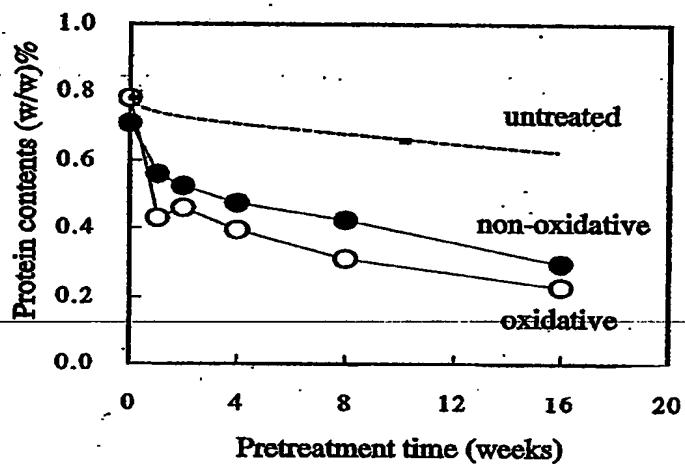


Fig. 64